Centre for Nuclear Engineering
Newsletter

June 2013

Issue | 2

Welcome to the CNE newsletter, there have been many exciting developments in the CNE over the last few months and we thought that this would be the best way to let everyone know about them.

Exciting News

by Emma J. Warriss and Edoardo Giorgi

Professor Robin Grimes becomes CSA for the FCO

Robin has been appointed as the Chief Scientific Officer for the Foreign and Commonwealth Office, replacing Professor David Clary. Robin will be stepping back as Director of the CNE but will remain active in the CNE as Founding Director. Professor Bill Lee is now Director for the CNE.

Prof Bill Lee awarded the William Penney Fellowship

From Feb 1st 2013 Prof Bill Lee has become a William Penney Fellow of AWE. This will enable him to spend 1 day/week to extend the College's engineering links with AWE, in particular he will set up and direct the Imperial-AWE Centre for Engineering and Manufacturing Studies (CEMS). The fellowship is named after William Penney who was Rector of Imperial from 1967-73 and had previously headed the British delegation to the Manhattan project during WWII and was on the UKAEA board from 1954-67.

Seminar Series and Internal Lecture Series

Our seminar series was kicked off in January by Professor Tim Haste, IRSN and was followed in March by Richard Swinburn, Head of Technology, Civil Nuclear, Rolls-Royce. The seminar in April was given by Professor Wyn Bowen, Kings College London, Mays seminar was by Ann McCall, SKB and the June seminar was given by Paul Thompson, AWE. A full seminar timetable will be published in the near future.

Nuclear Advisory Committee

A Nuclear Advisory Committee has been initiated for the CNE and will have its first meeting on 9th-10th July. It comprises senior representatives from industry across the UK and Europe. The meeting will include presentations from all departments and a poster lunch session for all the centre members.

Fukushima Clean-Up - Visit of Leading Japanese Scientists

On March 15th the CNE received a visit from Professor Saturo Tanaka and Professor Saito from the University of Tokyo to discuss the R&D and new technology needs to decontaminate the Fukushima site.

The Japanese Government has promised that all of the radioactive materials, released by the nuclear accident following the tsunami, will be removed from the Fukishima prefecture .The scale and complexity of this task creates opportunities for new and improved decommissioning and waste treatment.

One challenge is the removal of tritium from the waste water used to cool the reactors and spent fuel stores.

During his visit Professor Tanaka made time for a discussion with Sam Murphy on his research on atomistic modelling.

Professor Tanaka will return to Imperial in May.

Anyone wishing to meet him should contact Matthew Eaton or Emma Warriss.

CNEMC

A Centre for Nuclear Engineering Management Committee (CNEMC) has been organised by Professor Bill Lee. This committee meets on a monthly basis and has a representative from each department involved with the CNE.

Advanced Boiling Water Reactor Plans for the UK

At a seminar on January 30th in the Royal School of Mines, Hitachi -GE described their plans to build Advanced Boiling Water Reactors at Wylfa on Anglesey and Oldbury in Gloucestershire in 8 presentations covering all aspects of design and reactor control including the lessons learned from Fukushima.

The delegation was led by Dr Kumiaki Moriya, Chief Engineer of Hitachi –GE Nuclear Energy and he also gave the main presentation on the ABWR Design Concept.

The seminar was attended by over 100 delegates from the nuclear industry, DECC and other Universities.

New Faces Rebecca Jeffers

Rebecca joined Dr Matthew Eatons team of researchers on nuclear physics modelling on October 1st 2012.

The title of her PhD, sponsored by EDF and ESPRC is:

'Goal based coupled adaptive mesh refinement (AMR) and angular adaptivity on cartesian meshes for modelling neutron transport in PWR reactor cores'

Rebecca's description of her project and her reasons for choosing this topic are given overleaf.

Project Description:

The purpose of this project is to develop techniques for the efficient modelling of neutron transport in pressurised water reactor (PWR) cores. The transport of neutrons is governed by the Boltzmann transport equation, a complex function of space, energy, angle and temporal variables. The problem is computationally demanding. The aim is to develop fully automatic adaptive procedures on Cartesian meshes that enable the mesh and angular discretisation to be locally refined if needed. Reliable local error metrics are required to identify where refinement is needed. The error metrics used to drive the automatic refinement strategy will give estimates for the error incurred in discretisation as well as estimates for the error in key quantities such as the K-effective and reaction rates.

Biography:

Given that I wanted to work for the energy industry, and that mathematics and physics were my favourite A level subjects, I decided to study a bachelor's and master's degree in "Aeronautical and Aerothermal" engineering at Clare College, Cambridge University. My first experience of working in the nuclear power industry was during a summer placement at Wylfa power station. I found the work very interesting and the sense of community in the work place very rewarding. This inspired me to complete a master's project developing a tritium environmental release model. This experience of research confirmed my suspicions that I wanted to go on to postgraduate research. I enjoyed numerical methods and writing my own CFD code as part of my undergraduate degree and was keen to undertake a research project that was more mathematical than the one I had completed for my Master's degree. This doctorate therefore seemed like the perfect option.

Rolls-Royce UTC - by Frederic Sebilleau

The Royce-Royce Nuclear UTC has recently recruited six new PhD and EngD students to work on a wide range of thermal–hydraulic topics relevant to the nuclear industry. The main aim of this activity is to develop CFD and systems code capabilities to aid in the prediction of the complex flow patterns and heat transfer processes arising in the cooling of nuclear reactors.

Three projects are related to the study of flows in non-circular ducts: Prediction and measurement of velocity fields (David Harland), Phenomenological modeling of Critical Heat Flux (Ifeanyi Ezemonye-Agwuegbo) and Modeling of boiling and Critical Heat Flux (Ronak Thakrar). The majority of the research carried out so far has been done for circular ducts. The extension of these studies to non-circular ducts is particularly important for nuclear submarines.

Another project is focused on the coupling of system codes to CFD codes (Morgan Cowper). This project may actually focus on the prediction of buoyancy driven flows with system code/CFD simulations. The CFD study of buoyancy effects and especially counter-current flows is another project on its own (Frederic Sebilleau). Very little research has been done so far on the characterization of this challenging type of flow.

Finally, another project is about the fundamentals of the boiling process, with final aim, among other things, of studying the bubble nucleation and bubble behavior in the vicinity of rough surfaces using a DNS (Direct Numerical Simulation) approach (Giovanni Giustini). This DNS capability, based on commercial codes, has been recently benchmarked in the research group and may now be used in several of these projects as a tool that can be regarded as a "numerical experiment".

Student Placements

If you have any contacts that would be willing to offer our nuclear UG's and MSc's students industry placements please could you contact Emma Warriss with the details.

Featured Meetings

by Zoltan Hiezl

The 2nd International Seminar on Global Nuclear Human Resource Development for Nuclear Safety, Security and Safeguard

was held in Japan between 18 and 26 February, 2013. It comprised a two-day conference with lectures presented by highly regarded experts in the field, three days of seminar sessions focusing on the reasons for and consequences of the Fukushima Daiichi Accident, followed by fieldwork in the Fukushima area and a visit to the Onagawa Nuclear Power Plant. At this seminar the UK and Imperial College London was represented by Zoltan Hiezl, one of the four invited participants from Europe. The event was fully funded by Tokyo Institute of Technology.

At the conference it was shown that despite of the Fukushima Accident, many countries, including Malaysia, Indonesia, Korea and Vietnam, are developing their nuclear technology. With regards to the remediation of the ^{134}Cs and ^{137}Cs contaminated area, Japan has different approaches. Such solutions are top-soil removal or contaminated area coverage with a few cm of fresh soil. For water treatment, there are on-going experiments that addresses the absorption properties of $Fe_4[Fe(CN)_6]_3$ (Prussian blue). However, it may take decades before the results from experimental phase can be applied in real environment. During the fieldwork at Fukushima, it was seen that the background radiation is about 10 times higher than in Tokyo and at certain hotspot it can goes up to 20-25 μSv/h.

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